G R A P H I C S E D I T O R

D E M O P R O G R A M

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INTRODUCTION

The GREDIT.B file contains a simplified graphics editor program written in MTU BASIC and uses the CIL and IGL Libraries. This program is designed to serve two purposes. First, it is intended to provide examples of how to use the IGL and CIL Libraries in an actual application program. Second, it is intended to be a used as a program for creating, editing, and saving graphics images using a simple graphics data base.

STARTUP

To start up the program, simply enter MTU BASIC with a BASIC command and then execute the command:

```
RUN "GREDIT"
```

The program will "LIB" in the CIL and IGL Libraries itself, so the disk in drive 0 must contain these libraries.

GENERAL DESCRIPTION

The GREDIT Program is a menu driven application program. It uses the legend boxes as the menus and the function keys as the means of selection. In the next section, descriptions of the various menus and the function of each selection are given.

The function of the GREDIT program is to provide a simple graphics editor. It allows you to create and edit a graphics image. Where a word processor allows you to edit words, the GREDIT program allows you to edit lines in an image.

The image manipulated by the GREDIT program will consist of lines and characters. The lines and characters to be drawn will be specified by you when you enter or edit the image. The program records where the lines and characters are positioned using screen coordinates. This means the image may occupy a coordinate range of 0 to 479 horizontally, and 0 to 255 vertically. Because the GREDIT program uses some of this area for the legends and prompt messages, the usable image area is slightly less. The usable area is about 10 to 479 horizontally, and 30 to 250 vertically.

What is actually created and displayed by this program is a simple graphics data base. This graphics data base consists of a sequence of commands which specify how the image should be drawn. These commands will be referred to as "entries" in the data base.

To enable you to create your image, three drawing functions are provided. These are move to a point, draw to a point, and print character string. An individual line is specified by moving to the starting point, then drawing to the end point. It is also possible to draw a line by drawing from the previous end point to a new end point. A character string is displayed at a desired point by first moving to that point and printing the character string.

The GREDIT program has five types of data base entries to support the three drawing functions just described. There are two types of entries which perform the move function. The first is called a MOVE entry. In this entry, the point to move to is specified explicitly. The second is called an RMOVE entry. In this entry, the point to move to is specified relative to the previous end point. There are also two types of entries which perform the draw function. These are called DRAW and RDRAW entries. The draw entries will draw from the previous end point to the end point specified in the entry. In the DRAW entry, the end point is specified explicitly. In the RDRAW entry, the end point is specified relative to the starting point. The fifth entry performs the character string printing. This is called a LABEL entry. It will print the character string contained in the entry, starting at the previous end point. By using the appropriate combination of entries, almost any simple image can be created.

The GREDIT program also has subshape capabilities. A subshape is a collection of entries which have been given a name. A subshape is most useful when a certain piece of an image appears in several places. You first define how this piece (i.e., subshape) is drawn and assign it a name. You then call for the subshape to be drawn at each of the desired locations. This saves entering the same sequence of entries more than once in the data base.

There are two types of entries which support the subshape capability. The first is the SHAPE entry. This entry defines the name of the subshape whose entries appear in the data base immediately following the SHAPE entry. The SHAPE entry will contain the six character subshape name. The second type of subshape entry is the DRSHP entry. This is the entry which calls for a subshape to be drawn. The subshape will be drawn starting at the previous end point.

For greater flexibility, the GREDIT program allows a subshape to call other subshapes (up to 20 levels deep). For example, a subshape called "BOX" may contain DRSHP entries for another subshape called "SQUARE". However, a subshape must not call itself, i.e., the "BOX" subshape must not contain a DRSHP BOX entry.

There is one other type of entry supported, which is the END entry. This entry is found at the end of the entries for each subshape, and at the end of the data base. The END entries are controlled automatically by the GREDIT program.

The GREDIT program organizes the data base into two parts. Starting at the beginning of the data base are all the subshape definitions and their entries. Following the subshape entries come the main drawing entries. This is where the entries which draw your image begin. When you call for the entire image to be draw, the GREDIT program will start drawing with the first main drawing entry. The subshape entries are placed before the main drawing entries to make the subshapes easier to find.

For editing purposes, the GREDIT program maintains a current entry pointer. Many of the editing functions involve the current entry in some way. Also, during most of the editing fuctions a portion of the data base is displayed in the upper right corner of the display. This display will show the two entries preceeding the current entry (if they exist) , followed by the current entry, followed by the two entries after the current entry (if they exist). The current entry will always be indicated by an arrow.

Entries are added to the data base using the INSERT menu. Entries will be inserted just prior to the current entry. As each entry is inserted it is also drawn on the display. This allows you to see what you are inserting. Editing functions include DELETE and ADJUST. The DELETE function removes an entry or entire subshape from the data base. The ADJUST function allows you to adjust all appropriate entries by the same amount.

To allow you to reposition the current entry pointer, there is a separate JUMP menu. You may jump to the entry at the beginning or end of the main drawing entries, or any subshape. You can also jump forward or backward in the data base a specified number of entries. You can also search for a point (FIND PNT function). The restriction is that this point must be the beginning point (i.e., the end point of the previous entry) of an entry. If found, the current entry pointer points to the next entry. There is also a DRAW menu to allow you to redraw the entire image or to redraw the image in increments.

There are functions to load and save all or portions of the data base to and from disk. When saving, you may write all of the data base, all of the subshapes, or just selected subshapes to disk. When loading, you may load the entire data base, or just add the main drawing entries in the file on disk to those in the current data base. Finally there are disk functions and some general purpose functions, such as listing the subshape names.

The functions provided should be sufficient to allow you to deal with simple gaphics images. The best way to learn how use GREDIT is through actual use. Refer to the following sections for details on the various functions in each of the menus.

FIRST MAIN MENU

In this menu the screen will contain axes across the top and left side of the screen. The small tic marks represent intervals of 5 pixels, and the larger marks represent 25 pixels. Also, the data base display is maintained in the upper right corner of the screen. The following choices of functions are presented in this menu:

LEGEND	FUNCTION
ADVANCE	Advance the current entry pointer to the next entry.
BACKWARD	Move the current entry pointer backward to the previous entry.
INSERT	Insert new entries between the previous entry and the current entry. See the INSERT MENU.
DELETE	Delete the current entry. The next entry will become the current entry. If the current entry is a SHAPE entry, the subshape and all its entries are deleted.
DRAW	Draw all or part of the data base. See DRAW MENU
DEF SUB	Adds a new subshape to the data base. You will be prompted for a subshape name which may be up to 6 characters long. A SHAPE entry will be placed in the data base at the end of all the subshape entries already present. An END entry is inserted along with the SHAPE entry to indicate the end of the entries for this subshape. The current entry pointer will point to this END entry so you may immediately use the INSERT command to put entries into this subshape.
JUMP	Move the current entry pointer by various amounts. See JUMP menu.
OTHER	Jumps the SECOND MAIN MENU.

SECOND MAIN MENU

This menu maintains the same display as in the FIRST MAIN MENU. In this menu, the SAVE, SAVE SUB, and LOAD functions will request a file name. If you wish to include a drive number in this file name, you must enclose the entire file name within double quotes. This is necessary to keep BASIC from interpreting the ":" as a terminator. The following functions are provided in this menu:

LEGEND	FUNCTION
ADJUST	Adjusts MOVE, RMOVE, DRAW, and RDRAW type entries by a fixed amount. You will be asked to identify a point to be moved. Next you will be asked to identify where to move this point. Based on this input, a displacement is calculated. You will then be asked if you wish to adjust the current entry. You may respond by hitting "Y", "N", or "Q" keys to answer "YES", "NO", or "QUIT", respectively. If you answer with "Y", the displacement will be added to the coordinates of the current entry. After this entry is adjusted, succeeding entries will be drawn until the next MOVE, RMOVE, DRAW, or RDRAW entry is found or the end of the data base is encountered. This new entry is made the current entry and the data base entries are redisplayed. You will then be asked if you wish to adjust this new current entry. Responding with "N" performs the same as for "Y" except the entry is left as is. Responding with "Q" returns you to the SECOND MAIN MENU.
LIST SUB	Lists the names of all the subshape names in the data base.
SAVE	Saves the current graphics data base on disk. You will be asked to enter a file name. If the file specified already exists, you will be prompted again for a file name. If the file does not exist, then all of the current data base is saved in this file. Answering with just a carriage return will return you to the SECOND MAIN MENU.
SAVE SUB	Save subshape definitions to a data base disk file. You will first be asked to enter a file name. Next a message about the existence of the file is printed, and you are asked if you wish to save all the subshapes in the current data base. Enter "Y" to save all the subshapes in the current data base. Note that if the file already exists, then the subshapes will be appended to those in the file. This will overwrite any main drawing entries that may be in the file leaving only subshapes in the file. The program returns to the menu when it is finished writing the subshapes. Enter "N" if you wish to save selected subshapes, or no subshapes. After entering "N", you will be asked to enter a subshape name. Entering a subshape name will cause that subshape definition to be written to the file. The program then prompts you for another subshape name. Answering with just a carriage return will return you to the SECOND MAIN MENU.
LOAD	Load a graphics data base file from disk. You will first be prompted to enter an existing file name. Answering with just a carriage return will return you to the SECOND MAIN MENU. If the file name entered does not exist, you will be prompted again for a file name. If the file does exist, it is assigned to CODOS channel 5. You will then be asked if you wish to load all of the data base or just the main drawing entries. Answer with "A" to load all the data base. The data base loaded will replace the current one. Answer with "M" to load just the main drawing entries. The entries loaded will be added to the end of the main drawing entries of the current data base.

LEGEND	FUNCTION
DISK CMD	Jumps to DISK COMMANDS MENU.
TO CODOS	Returns to CODOS.
EXIT	Jumps back to the FIRST MAIN MENU.

INSERT MENU

When you enter the INSERT MENU, GREDIT determines if you are inserting into the main drawing commands or a SUBSHAPE. If you are inserting into a SUBSHAPE, you will be asked to enter a point from which to draw the SUBSHAPE. At this point the data base is drawn from the beginning of the SUBSHAPE up to but not including the current entry. If you are inserting into the main drawing commands, there will be a pause while a portion of the data base is redrawn. This is done so that the GRIN cursor will appear at the end point of the entry just prior to where entries will be inserted into the data base. Once this is done, the INSERT MENU is presented and the GRIN cursor is displayed. You may now insert as many entries as you like while in this menu. Each entry inserted will be drawn as it is entered keeping the image on the screen up to date.

LEGEND	FUNCTION
MOVE	Insert a MOVE entry into the data base. You should first position the GRIN cursor to the point you wish to move to, then press this key.
DRAW	Insert a DRAW entry into the data base. You should first position the GRIN cursor to the point you wish to draw to, then press this key.
RMOVE	Insert an RMOVE entry into the data base. You should first position the GRIN cursor to the point you wish to move to, then press this key.
RDRAW	Insert an RDRAW entry into the data base. You should first position the GRIN cursor to the point you wish to draw to, then press this key.
DRAW SUB	Insert a DRSHP entry into the data base. You will be prompted to enter a subshape name. If the subshape is defined it will be drawn upon insertion of this entry. Responding with just a carriage return will exit back to the INSERT MENU without inserting a DRSHP entry. The subshape will be drawn starting at the end point of the previous entry.
LABEL	Insert a LABEL entry into the data base. You will be prompted to enter a label string. This string may be up to 80 characters, which is all that will fit on one line. The string will be drawn starting at the end point of the previous entry.
ADVANCE	Draw the current entry and advance the current entry pointer to the next entry.
EXIT	Jump back to FIRST MAIN MENU.

DRAW MENU

When you first enter the DRAW MENU, GREDIT will determine if the current entry pointer is pointing into the main drawing commands or a subshape. If it is a subshape, you will be prompted to enter a point from which to draw the subshape. The DRAW MENU then presents the following functions for drawing all or part of the main drawing commands or subshape:

LEGEND	FUNCTION
ALL	Draws all of the subshape or main drawing commands after first clearing the screen.
FROM BEG	Draws from the beginning of the subshape or main drawing commands up to but not including the current entry.
DRAW 10	Draw the next 10 entries. Drawing a subshape counts as one entry.
DRAW 5	Draw the next 5 entries. Drawing a subshape counts as one entry.
DRAW 1	Draw the next entry.
STEP	Draws the current entry and advances the current entry pointer to the next entry.
SAVE IMG	Saves the screen image to the printer or disk file. You will be asked to select to save the image to the printer or disk file. Entering "P" prints a copy of the image on the screen to the printer. For this to work you must have a copy of SPRINT.Z on the disk in drive 0. Entering "F" will save the image as a memory save to a CODOS file. In this case, you will be asked for a file name. Responding with just a carriage return will return you to the DRAW menu without saving the image. Responding with a key other than "P" or "F" to the first prompt will also return you to the DRAW menu.
EXIT	Jumps back to the FIRST MAIN MENU.

JUMP MENU

The JUMP MENU presents the following functions to allow you to reposition the current entry pointer in various ways:

LEGEND	FUNCTION
TO BEG	Sets the current entry pointer to the first main drawing entry.
TO END	Sets the current entry pointer to the end of the main drawing entry.
TO SUB	Sets the current entry pointer to the first drawing entry in a subshape.
TO S END	Sets the current entry pointer to the end of the drawing entries in a subshape.
FIND PNT	Finds where a specified beginning point occurs in the data base. You will be asked to enter the point to search for. This point should be the beginning point of one of the entries in the data base. The search will begin with the current entry. The search is accomplished by drawing (or redrawing) entries one at a time, checking the beginning point of each entry before it is drawn. If a match is found the searching stops. The current entry will be this entry. At this point the data base will be displayed and you will be asked if this is the desired entry. If so, enter Y for "yes". If not, enter N for "no", and searching will resume. You may also enter Q for "quit", if you wish to stop the search at this point. Searching will stop and the query given no matter where the match occurs. The match may be within a subshape. The search must begin with the current entry pointer pointing in the main drawing entries. It cannot start within a subshape, though it may stop within a subshape. If a match is not found when the end of the data base is reached, the current entry pointer is reset to the beginning of the main drawing entries.
FORWARD	Move the current entry pointer forward a specified number of entries.
BACKWARD	Move the current entry pointer backward a specified number of entries.
EXIT	Jump back to FIRST MAIN MENU.

DISK COMMANDS MENU

LEGEND	FUNCTION
OPEN 0	Opens drive 0.
OPEN 1	Opens drive 1.
CLOSE 0	Closes drive 0.
CLOSE 1	Closes drive 1.
FILES 0	Clears the screen and executes a "FILES 0" command.
FILES 1	Clears the screen and executes a "FILES 1" command.
DELETE	Deletes a file. You will be prompted to enter a file name to be deleted. If this file name is to include a drive number, it must be enclosed within double quotes. Otherwise the ":" will be interpreted as a terminator and the drive number will be ignored.
EXIT	Jumps back to the SECOND MAIN MENU.

THE DATA BASE FORMAT

The following is a description of the format of the data base as it is found in memory and on disk. This should prove useful if you wish to make enhancements to the GREDIT program or put the data base to other uses.

Under BASIC, the entire data base is stored in the integer array DD%(). The data base consists of drawing entries, which are divided into two sections. These are the subshape section and main drawing entries section. The two sections are stored in the array DD%() as follows.

```
DD%(0)                          - pointer to the first main drawing entry.
DD%(1) to DD%(DD%(0)-1)         - The subshape entries.
DD%(DD%(0)) to DD%(PE-1)        - The main drawing entries
```

where PE is a pointer to the first array element beyond the END entry at the end of the data base. If the data base contains no subshapes, then DD%(0) will contain 1 and DD%(1) will contain the first main drawing entry.

There are seven different drawing entries. These entries are MOVE, DRAW, RMOVE, RDRAW, DEFINE SUBSHAPE, DRAW SUBSHAPE, and LABEL. The format for these in the data base is shown below for an entry starting at DD%(I):

```
MOVE Entry      DD%(I)    = 1 for MOVE, = 2 for DRAW
and             DD%(I+1)  = X coordinate
DRAW Entry      DD%(I+2)  = Y coordinate
                DD%(I+3)  = Length of entry = 4

RMOVE Entry     DD%(I)    = 3 for RMOVE, = 4 for RDRAW
and             DD%(I+1)  = Relative X coordinate
RDRAW Entry     DD%(I+2)  = Relative Y coordinate
                DD%(I+3)  = Length of entry = 4

DEFINE          DD%(I)    = 5
SUBSHAPE        DD%(I+1)  = Length of subshape
Entry           DD%(I+2)  = Subshape name
                to          1 character per array element
                DD%(I+7)
                DD%(I+8)  = Length of entry = 9

DRAW            DD%(I)    = 6
SUBSHAPE        DD%(I+1)  = Name of subshape to draw
Entry           to          1 character per array element
                DD%(I+6)
                DD%(I+7)  = Length of entry = 8

LABEL Entry     DD%(I)      = 7
                DD%(I+1)    = Length of entry = L+3
                DD%(I+2)    = Characters of label
                to            1 character per array element
                DD%(I+L)      L = number of characters in the label
                DD%(I+L+1)  = Length of entry = L+3
```

The format for the END entry is:

```
END Entry       DD%(I)      = 0
                DD%(I+1)    = Length of entry = 2
```

A data base file on disk contains a memory image copy of the data base in DD%(). This copy of the array DD%() is preceeded by an integer (i.e. two byte signed representation) containing the number of integers in the rest of the file. This integer is actually the quantity PE for the data base in the file. Because it is a copy of the DD%() array, the second integer in the file (i.e. the one following the count) is equivalent to DD%(0). The next integer is equivalent to DD%(1), etc.

Because all the numbers in the data base are BASIC integers (i.e. two byte signed quantities), it is not difficult for another BASIC or machine language program to access a data base file on disk. To read a data base file using BASIC and the CIL, the following command may be used:

```
SYSTEM "ASSIGN 5 YOURDB.D":BLKRD@ 5,PE%,DD%(0) TO DD%(PE%-1):SYSTEM "FREE 5"
```

Because of the way BASIC handles numbers, the most significant byte of each integer preceeds the least significant byte in the file. This is especially important if you are accessing the file from machine language.